

## Bermuda Caves 2009 expedition

### Multibeam survey plans and data

This survey will be carried out under Dr. Rikk Kvitek, Director of the Seafloor Mapping Lab (SFML) at California State University, Monterey Bay. A Reson Seabat 7125 multibeam echosounder system will be used for data acquisition. This system is capable of meeting the project requirements in terms of depth and resolution. Position and attitude control will be provided by a CodaOctopus F185+ motion and navigation sensor. Sound velocity profiles will be collected at intervals throughout the data acquisition with an Applied Microsystems SVP for correction of refraction artifacts and ray bending. Data will be acquired with Triton Isis software and processed using CARIS HIPS multibeam processing software. Products will include 3D point clouds, and digital elevation models (DEMs) used to look for potential cave sites. Data will be visualized and explored in IVS Fledermaus as 3D point clouds to aid in the search for and identification of caves. Geotif images of the DEMs in shaded relief colored by depth and in gray scale will be created for use during the ROV surveys to aid in navigation and piloting of the ROV.

The Seafloor Mapping Lab will provide a SeaBotix LBV200L2 ROV equipped with a 250m umbilical and a depth rating to 200m. The LBV200L2 is equipped with four powerful, oil-compensated, Brushless DC Thrusters. There is 1 lateral, 2 forward and 1 vertical thruster, enabling maneuverability in four axes, just like a helicopter. The additional lateral thruster adds the capability to fly sideways, allowing the operator to keep either camera on target while piloting along a vertical surface. On-the-fly, 10 step variable power control to each axis allows for smooth video and sensor recording. The extremely small-diameter of the fiber optic umbilical presents less drag meaning the vehicle is controlled by the operator, not the umbilical. The Fiber Optic video system provides crystal-clear images from the standard high-res cameras. Both cameras have a total 270 degree field of view through 180 degree rotation of the camera enclosure. The internal, fully-adjustable LED lighting array provides brilliant, white light and tracks the color camera. The programmable Video Overlay displays heading, depth, temperature, cable turns, and time/date.

The LBV 200 will be used to explore any sites identified in the preliminary multibeam data as potential cave area. The ROV pilot will be able to view the position of both the surface vessel and ROV superimposed on the multibeam image. In addition to the video cameras and acoustic tracking, the ROV's onboard sonar system will also aid in locating targeted seafloor features. The ROV flight path and georeferenced video imagery will be digitally recorded in real-time for later playback. The flight path, recorded in Hypack software will also be converted to ArcGIS shapefiles for later display over the multibeam bathymetry imagery.

Data products: All digital data products from both the multibeam and ROV surveys will be provided to the project leader on USB hard drives. These will include:

Bathymetry data

- Xyz ASCII soundings
- DEM raster grids
- Shaded relief geotifs gray scale
- Shaded relief geotifs colored by depth
- Contour shapefiles

ROV data

- Video data as digital files with UTC timestamp and georeferencing
- ROV track line shapefiles
- Target files with position and time in ASCII format